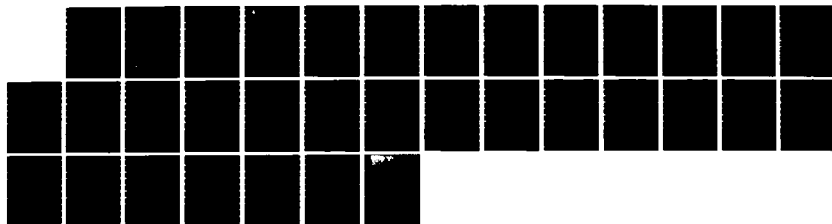
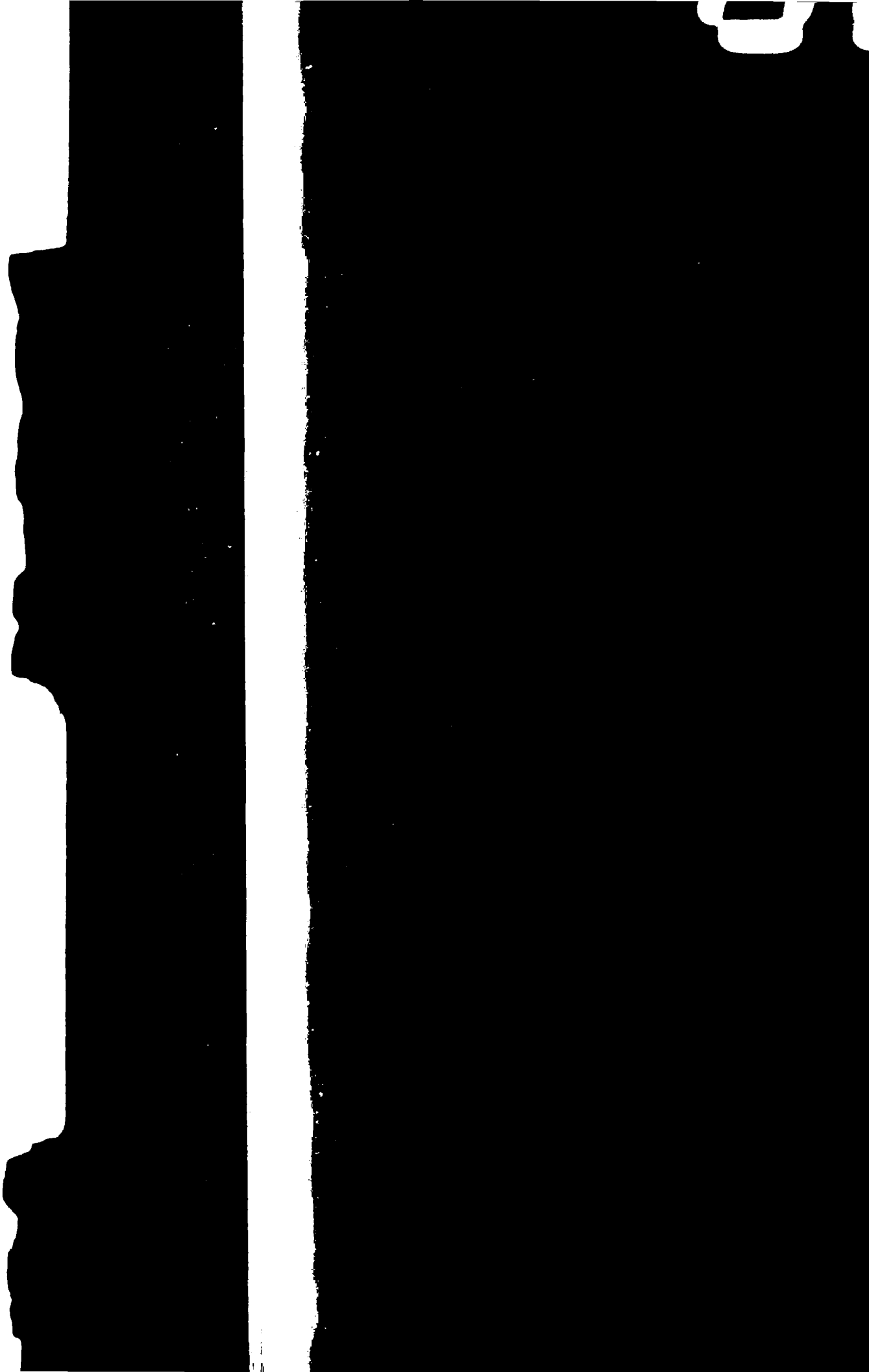


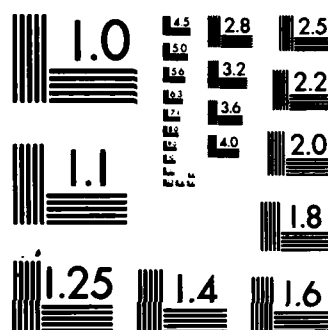
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BY THE U.S. GENERAL ACCOUNTING OFFICE

## Report To The Secretary Of The Navy

# Navy Can Improve Management Of Shipyard Labor Resources Through Better Work Measurement Practices

This report discusses methods the Navy can use to improve its work measurement and cost accounting systems to control rising labor costs. For example, improvements are needed to

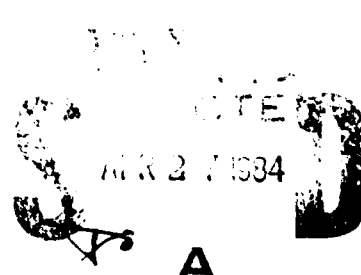
- implement work measurement systems effectively;
- control labor-charging practices better, and
- set organizational goals and use individual performance appraisals to support management's efforts.

GAO makes a number of recommendations designed to improve the management of shipyard labor resources through better work measurement practices. The Department of Defense generally agreed with GAO's findings and recommendations and outlined actions planned to improve Navy work measurement activities.

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UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

NATIONAL SECURITY AND  
INTERNATIONAL AFFAIRS DIVISION

B-214784

APRIL 24, 1984

The Honorable John F. Lehman  
The Secretary of the Navy

Dear Mr. Secretary:

This report points out that the Navy can improve its management of shipyard labor resources through better work measurement practices.

We discussed a draft of this report with representatives of the Office of the Secretary of Defense (Manpower, Installations, and Logistics) and the Navy. Their comments have been incorporated, where appropriate, in the report.

The report contains recommendations to you on pages 13, 19, and 23. As you know, 31 U.S.C. § 720 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the Director, Office of Management and Budget; the Chairmen, House Committee on Government Operations, Senate Committee on Governmental Affairs, and House and Senate Committees on Appropriations and on Armed Services; and the Secretary of Defense.

Sincerely yours,

Frank C. Conahan  
Director

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GENERAL ACCOUNTING OFFICE  
REPORT TO THE SECRETARY  
OF THE NAVY

NAVY CAN IMPROVE MANAGEMENT  
OF SHIPYARD LABOR RESOURCES  
THROUGH BETTER WORK  
MEASUREMENT PRACTICES

D I G E S T

Naval shipyards spent over \$3.4 billion last year on fleet depot maintenance. About \$2.2 billion of this, or 65 percent, was for labor costs. GAO reviewed the adequacy of shipyard work measurement and cost accounting systems, which give managers the information needed to effectively manage labor costs.

WHAT THE REVIEW DISCLOSED

Work measurement consists of the most efficient method for doing a specific task and then identifying how much time should be allowed to do it. This information is incorporated into labor standards, which predict the time required for an experienced person to complete a task at a normal pace in a predetermined sequence or manner. Cost accounting systems tell how many labor-hours were actually charged to the work and help managers assess performance and identify problems.

On several occasions GAO reported that the Navy needed to improve its work measurement and cost accounting systems to effectively control rising labor costs. Although the Navy agreed and took some corrective action, GAO's evaluation indicates that, overall, work measurement and labor costing have been given low priority. As a result, many previously reported problems still exist. In particular:

- Many labor standards were not properly documented and some were based on invalid techniques. (See pp. 6 and 7.)
- Shipyard planners did not justify increased time allowances for work already covered by labor standards supposedly generated from time and motion studies. (See p. 7.)
- Planners did not properly apply standards in calculating the costs estimated to do a particular job ("should cost" allowances). (See pp. 8 to 10.)

--Personnel responsible for monitoring employee labor-charging activities have not been able to determine the degree of time mischarges and the accuracy of indirect labor being charged for "lost time" and "defective work and spoilage." (See pp. 16 to 19.)

--Individuals administering work measurement and cost accounting activities have not been held fully accountable for their performance, thereby lessening the emphasis on actions needed to correct problems. (See pp. 21 to 23.)

Naval Sea Systems Command (NAVSEA) reviews of shipyard operations over the last 2 years identified similar work measurement and labor-costing problems. These problems limit management's ability to, among other things, isolate weaknesses in performance of shipyard personnel, monitor the effectiveness of corrective actions, forecast workloads, and reduce costs.

Over the years, NAVSEA has issued instructions emphasizing the need to implement effective work measurement systems and ensure accurate time charges for shipyards. Also, NAVSEA has initiated programs to identify problems with "should cost" estimating procedures and labor charging. NAVSEA plans to issue additional guidance requiring shipyards to accurately charge labor. While these are steps in the right direction, NAVSEA and shipyards have not made the necessary continued progress toward implementing viable work measurement and cost accounting activities mainly because:

--Management has not made a firm commitment to operate and maintain a viable work measurement system.

--Sufficient staff have not been provided to administer work measurement activities.

--Labor standards and "should cost" estimates have not been effectively validated.

--Shipyards have not provided adequate training and technicians do not have the required expertise to ensure labor standards are properly developed, documented, and used.

--Programs designed to ensure accurate and reliable labor charges have not been fully implemented.

Although it is difficult to estimate the impact of these weaknesses on labor costs, performance measurement indexes in both the public and private sectors



show that millions of dollars can be lost through low productivity. GAO found an example demonstrating savings potential but could not make a meaningful analysis of the performance information because of questionable labor standards, improper application of labor standards, and erroneous labor charges. Unvalidated data concerning three submarine overhauls at one shipyard indicated that direct labor charges were as much as \$11.8 million more than would have been charged if work had been done at the minimum performance levels established by NAVSEA. (See pp. 2 and 3.)

#### RECOMMENDATIONS

To ensure the required management attention and resources are devoted to establishing effective and economical labor cost control practices at shipyards, GAO recommends that the Secretary of the Navy direct the Commander, NAVSEA, to

- establish an improved work measurement system by ensuring that labor standards are properly set, supported, and used in calculating "should cost" allowances (see p. 13);
- identify and provide the staff required to effectively administer shipyard work measurement programs and to do work measurement studies (see p. 13);
- develop training policies and plans which improve the skills required of those who administer, develop, and upgrade shipyard labor standards (see p. 14);
- implement stronger controls to validate the accuracy of labor-charging practices by making sure that labor checks are done more frequently, done in the prescribed format, and used to help management correct problems (see p. 19); and
- set organizational goals and objectives which address the quality of work measurement activities and include these activities in designing and incorporating mandatory entries on performance evaluations to measure the effectiveness of shipyard employees involved (see p. 23).

#### AGENCY COMMENTS

On March 16, 1984, GAO met with Department of Defense (DOD) and Navy officials to obtain DOD's official oral comments. DOD generally agreed with GAO's findings and recommendations and outlined the actions planned to improve work measurement and cost accounting activities. Concerning the recommendation on goals and

objectives, the spokesmen said that although organizational goals and objectives were being considered, DOD did not agree that incorporating mandatory entries on performance evaluations to measure effectiveness of shipyard employees was needed. DOD believed that problems existing in labor standards development and cost-charging practices would make it virtually impossible to obtain fair and objective measurements of performance.

GAO believes that those who administer, develop, and upgrade labor standards should be held accountable for their performance. This is an essential first step in eliminating weaknesses and, later, in maintaining effective systems. GAO believes that the performance appraisal process at shipyards is an excellent vehicle to ensure that personnel at all levels involved in work measurement implement and maintain a viable program.

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## ABBREVIATIONS

GAO	General Accounting Office
NAVSEA	Naval Sea Systems Command
SORT	Shipyard Operations Review Team

## CHAPTER 1

### INTRODUCTION

Between 1978 and 1982, labor costs at the eight naval shipyards increased from \$1.4 billion to \$2.2 billion, or about 57 percent. During this period, civilian staffing at the shipyards increased about 10 percent from about 66,000 to 72,600 employees.

The Chief of Naval Material manages fleet depot maintenance facilities, which include shipyards, and has delegated responsibility for program execution to the Naval Sea Systems Command (NAVSEA). NAVSEA establishes operating policies and performance standards which naval shipyards should use in planning and executing individual overhauls and in controlling labor costs. NAVSEA monitors and evaluates shipyard compliance with its guidance. NAVSEA instructions emphasize the importance of effective work measurement and cost accounting systems to properly manage labor resources and control labor costs.

### WORK MEASUREMENT AND COST ACCOUNTING SYSTEMS--WHAT ARE THEY?

Work measurement and cost accounting systems give managers information needed to effectively manage labor resources and minimize labor costs. Among other things, work measurement systems inform managers how many labor-hours a given task should require, and cost accounting systems tell how many labor-hours were actually charged to the work. This is entered in shipyard management information systems and serves as the basis for various activities, such as tracking and forecasting workload.

#### Work measurement system

Work measurement consists of identifying the most efficient method for doing a specific task and then determining how much time should be allowed to do it. This information is incorporated into labor standards, which predict the time required for an experienced person to complete a task at a normal pace in a predetermined sequence or manner.

Planners estimate workload by applying labor standards to anticipated work. Since the standards allow time for such factors as personal time and unavoidable delays, proper use of standards provides a good basis for determining how long it takes to do the work.

Shipyards develop and use three principal types of labor standards:

- engineered standards--standards set by shipyard methods and standards personnel using industrial engineering techniques, such as time and motion studies;

--uniform standards--engineered standards developed by a lead shipyard and approved by NAVSEA for use at more than one shipyard; and

--estimated standards--standards developed by shipyard planners based on a recorded analysis of the work and their trade expertise.

Shipyards are supposed to use these standards in estimating at least 90 percent of their production work. Because of the cost savings potential of using engineered methods and uniform standards rather than estimated standards, NAVSEA requires that 30 percent of the work be based on engineered and/or uniform standards.

#### Cost accounting system

The cost accounting system accumulates cost information by (1) type, such as labor and materials costs, (2) cost center, such as a specific production shop, and (3) job order number. Cost data is collected in this fashion to help managers assess performance and identify problems.

Labor charges, as reported on employee time cards, are the basis for labor cost accounting data. Time cards identify the employee, the cost center, and the number of hours charged to each job order number. Once supervisors certify that the information is accurate, it is also entered into the shipyard management information system.

#### Work measurement standards can reduce labor costs

Studies in the public and private sectors have shown that savings can be achieved through improved work methods and realistic labor standards. Further, to appraise management efficiency, performance factors can be used to compare output measured by the costs estimated to do the job (referred to as "should cost" allowances) with input measured by the actual number of direct labor-hours charged to the job. Thus, an effective work measurement system enables managers to isolate performance shortfalls and take actions to improve operations and minimize costs.

According to shipyard records, performance factors indicate that some shipyards perform more efficiently than others. For example, Norfolk's performance factors for regular overhauls, which had reached 1.20, were generally better than Mare Island's, which had reached 1.50. A performance factor of 1.50 indicates that, on the average, production shops charged 50 percent more time than planners estimated the work should have taken.

The following chart illustrates the cost reduction potential of improving shipyard efficiency. The chart indicates that \$11.8

million in labor costs would have been avoided had Mare Island completed three recent submarine overhauls within NAVSEA's "should cost" allowances. However, as discussed in chapters 2 and 3, weaknesses in Mare Island's procedures for estimating "should cost" allowances and for accumulating actual labor charges prevented better use of the performance factors in appraising managerial performance and in pinpointing problem areas. Therefore, we have little evidence to validate the accuracy of the \$11.8 million potential cost reduction.

<u>Submarine</u>	<u>Shipyard "should cost" (days)</u>	<u>NAVSEA allowance X 1.25<sup>a</sup></u>	<u>Cost guide (days)</u>	<u>Actual labor charges (days)</u>	<u>Actual exceeds guideline (days)</u>	<u>Labor cost per day</u>	<u>Potential cost reduction</u> (millions)
<u>Skipjack</u>	214,001	1.25	267,501	283,758	16,257	\$128.63	\$ 2.1
<u>Sculpin</u>	204,832	1.25	256,040	280,128	24,088	127.22	3.1
<u>Shark</u>	<u>212,068</u>	1.25	<u>265,085</u>	<u>315,881</u>	<u>50,796</u>	129.77	<u>6.6</u>
Total	<u>630,901</u>		<u>788,626</u>	<u>879,767</u>	<u>91,141</u>		<u>\$11.8</u>

<sup>a</sup>According to NAVSEA's work measurement manual, because of the nature of shipyard work (interruptions, unplanned work, lost time, unskilled workers, etc.), 1.00 performance would be difficult to maintain. The manual states, however, that consistent performance between 1.10 and 1.25 should be expected.

#### PRIOR REPORTS

We have issued several reports on the Navy's need to implement effective work measurement systems and improve the accuracy of its cost accounting information. In our March 1978 report entitled Naval Shipyards--Better Definition of Mobilization Requirements and Improved Peacetime Operations Are Needed (LCD-77-450, Mar. 31, 1978), we reported on weaknesses in shipyard work measurement and cost accounting systems and noted that they had been reported before. Specifically, we reported that good estimating techniques were not used at either Norfolk or Puget Sound naval shipyards and that management information systems did not produce reliable data for decisionmaking.

The Navy agreed and said corrective actions would be taken. For example, the Navy said a program plan had been developed directing shipyards to improve their work measurement systems and that errors in current systems had been identified and programmed for correction. In its June 1978 comments on our report, the Department of Defense stated:

" . . . The estimating techniques and work measurement systems employed in naval shipyards . . . are much improved over those techniques used in earlier years. For example, in naval shipyards today, planners and estimators estimate only on the basis of what the job 'should cost' . . . The estimating techniques and work measurement system . . . are based on sound industrial engineering practices, such as documented methods, processes, labor standards, performance measurement, and variance analysis." (Emphasis added.)

As discussed in chapters 2 to 4, the needed improvements have not been made.

#### OBJECTIVES, SCOPE, AND METHODOLOGY

Our principal objective was to evaluate the extent of controls over labor costs at naval shipyards. Specifically, we reviewed systems for developing and applying labor standards and for accumulating actual labor cost data. We also examined how NAVSEA and the shipyards used this information in managing labor resources and controlling labor costs.

Between January and September 1983, we worked at NAVSEA headquarters and at a shipyard on the East and West Coasts--the Norfolk and Mare Island naval shipyards, respectively. At each location, we obtained data and interviewed shipyard officials on work measurement and cost accounting systems.

We did not statistically analyze the validity of shipyard labor standards, "should cost" estimates, and time charges. Statistical analysis would have required an inordinate amount of effort because required documentation was not available. Therefore, a statistical analysis would have required us to duplicate industrial engineering analyses, such as time and motion studies. Such an effort was not warranted in view of the widespread weaknesses identified in the Shipyard Operations Review Team (SORT) reports and in other studies we examined.

Since 1980 NAVSEA has initiated several efforts to improve depot maintenance. One of these involves detailed shipyard reviews, started in 1982, by SORT. According to NAVSEA, the team is composed of proven performers from each shipyard who are selected for their knowledge and experience in shipyard operations. One of SORT's major objectives is to develop a new and coordinated approach to shipyard performance assessment and improvement. We reviewed SORT reports for the Long Beach, Pearl Harbor, Philadelphia, Norfolk, and Mare Island naval shipyards.

We made our review in accordance with generally accepted government auditing standards.

## CHAPTER 2

### SHIPYARDS NEED TO IMPLEMENT

#### EFFECTIVE WORK MEASUREMENT SYSTEMS

The effectiveness of management tools designed to increase productivity and reduce labor costs has been sharply reduced by weaknesses in work measurement systems at shipyards. NAVSEA has issued detailed guidance to ensure that shipyards implement effective systems, many of the problems we reported previously still exist. Poorly implemented labor standards and techniques have contributed to these problems. In many cases, standards have been poorly documented or improperly selected. Standards have not always been properly applied to determine much the work should cost. In addition, the shipyards have not assigned sufficient staff to the work measurement program, nor adequately trained those who were assigned. NAVSEA is addressing these problems and is beginning to address them. SORT reports provide a clear indication of NAVSEA's intentions. However, more needs to be done to ensure that corrective actions are

Several factors need to be addressed for work measurement systems to give management the data it requires to analyze shipyard productivity effectively. Managers at all levels who assign higher priority to work measurement, must commit themselves to operating and maintaining a viable system, and appoint sufficient staff to administer it. Technical personnel should have the required expertise and be trained to develop work standards properly and to ensure that methods and standards are considered in work measurement studies. Finally, control programs should be upgraded to improve the accuracy and reliability of a job's "should cost" and of the time element charge to jobs. Without these needed improvements, alone a strong management commitment, shipyard managers cannot accurately forecast workloads, (2) solve problems adequately, or encourage productivity through viable incentive programs.

#### WORK MEASUREMENT TECHNIQUES HAVE NOT BEEN PROPERLY IMPLEMENTED

Although NAVSEA and shipyard officials recognize that a good work measurement system can help control labor costs, they must actively support it and follow through on actions to make it work if they hope to realize these benefits. NAVSEA and shipyards generally have not implemented a viable work measurement system. Some problems in the way shipyards have implemented labor standards are discussed below. These problems include the sustained role which management at all levels must ensure that the system works as intended.



Engineered standards not properly  
set and documented

Many engineered standards we examined were not properly documented, and some were based on invalid techniques. Shipyard officials agreed that files should contain an organized account of what was done to arrive at the labor standards, down to the detailed work sampling data used in developing the standards. Organized files provide the data necessary for (1) review of labor standard times by personnel who do not agree with them, (2) analysis and review of methods, modification of work practices, and updating of standards, and (3) conversion to a computer-based standards system or until such a system is available, manual application to similar tasks not presently covered by engineered standards.

Of the 46 engineered standards we selected at Mare Island and Norfolk, we found that

- 21 did not have sufficient documentation to determine the basis for developing or modifying them,
- 13 were apparently not based on valid industrial engineering techniques, and
- 1 provided excessive allowances because of an error in calculations.

Shipyards had modified engineered standards or increased allowances for uniform and engineered standards using methods other than recognized industrial engineering techniques. Methods and standards personnel confirmed that work measurement studies were not always done in developing engineered standards. In a number of cases, shipyards significantly increased standards' time allowances based on planners' preferences or shop personnel input rather than on techniques such as methods analysis and time and motion studies. The following illustrates a case when this occurred at Mare Island.

Uniform Method and Standard 0563-803  
Overhaul Operator, Hydraulic, MBT Vent Valve

<u>Work description</u>	<u>Hours allowed by</u>		<u>Percent increase</u>
	<u>Uniform standards</u>	<u>Planners</u>	
Polish piston	0.7	4	571.4
Hone cylinder	0.7	4	571.4
Repair piston	2.2	6	272.7
Repair cylinder	1.7	12	705.9

As shown above, the modified standard currently used for this operation varied significantly from the uniform standard. The files contained no information on whether industrial engineering techniques had been used to arrive at the modified standard.

Norfolk officials also questioned the shipyard's engineered standards because many were old and/or lacked backup data. For example, of 185 engineered standards currently used, 167 were developed by a contractor. Shipyard officials noted that the contractor had not provided backup information for the time standards. They believed standards had been derived in part from negotiations with production shops and other shipyard organizations, rather than from time and motion studies.

SORT reports have identified problems with engineered standards too; however, in some cases, little corrective action has been taken. For example, a 1982 SORT study reported that although one shipyard was using approved labor standards to estimate a very high percentage of its production work, a majority of its standards were either obsolete or unusable. In May 1983, NAVSEA officials again visited the shipyard and found that:

"Development of engineered standards continues to be a low priority . . . Little, if any manpower has been allocated to the development of engineered standards for the past several years. Consequently, most of the engineered standards available . . . are considered unreliable by both Production Shops and Planners. Modifications made by planners to engineered and uniform standards based on return costs have destroyed the validity of the engineered standards baseline as a useful performance measurement tool."

### Estimated standards inflated

At the shipyards visited, it was difficult for us to evaluate whether estimated standards accurately reflected how much the work should cost because, generally, appropriate documentation was not readily available. However, documentation available for 3 of the 30 estimated standards we selected showed that planners had increased allowances for work already covered by engineered labor standards. These increases were made without the required written justification. Two examples follow.

--A July 1980 engineered standard provided about 11,000 hours to install and monitor strip heaters and was based on around-the-clock work sampling of welding activities. Planners later developed an estimated standard that provided about 18,000 hours to do the same tasks. We reviewed three ships and found in all cases the estimated standard had been used, providing about 21,000 more hours to do the work than the engineered standard allowed. The planner who had written the estimated standard indicated that he had not checked to determine whether an engineered standard existed and further stated that he had relied on an old estimated standard rather than a detailed assessment of what was needed.

--An August 1982 engineered standard would have provided 8,158 hours on the SSN 613 submarine for cleaning during the overhaul. However, planners developed an estimated standard, without justification, that increased allowances for this work to 24,000 hours.

In 1982, Mare Island initiated an extensive program to identify inflated estimates and reduce labor costs. The program compared Mare Island's procedures with those of the Puget Sound shipyard. The comparison indicated, from a summary prepared in August 1983, that many planners overestimated the time it took to do jobs, often leading to gradual increases in funding from ship to ship. The study recommended that engineered standards be developed to realistically reflect the "should cost" estimate for the work. At the time our fieldwork was completed, Mare Island was taking the recommended action.

Our work at Norfolk further confirmed this problem. Although Norfolk established a program to review estimated standards, the program emphasized application of standards; it did not include an assessment of whether they were set at appropriate levels. A Norfolk official stated that backup files generally did not have the information for such an analysis.

### Standards applied improperly

NAVSEA requires shipyard planners to document the application of standards in calculating "should cost" allowances and the reasons for any deviations. At Mare Island, however, planners did not document their "should cost" calculations. In several

cases, planners increased allowances based on undocumented judgmental factors they had difficulty recalling.

The lack of support for job order allowances is not a recent occurrence at Mare Island. Mare Island records from December 1980 indicated that planners were not knowledgeable about standards and were not using them properly. According to the files, planners did not always use the proper standards and did not record "units of measurement" (such as staff-hours) in calculating allowances. In August 1981, the shipyard noted that procedures for documenting calculations did not meet NAVSEA's criteria. Methods and standards personnel stated that without adequate documentation, there could be no verification that allowances were based on standards.

These problems continued to exist in 1983. Although required, many planners did not (1) prepare or retain the work sheets used to calculate allowances, (2) document elements not covered by existing standards, and (3) show how these elements had been estimated. Also, we did not find any evidence of supervisory review and approval for deviations from standards. Without such information, we could not assess the validity of "should cost" allowances at the shipyards visited. However, in several cases, planners allowed more time for specific jobs, without adequate analysis, than published standards warranted. For example, planners:

- Allowed 1,524 hours to remove 124 flasks while referencing an engineered standard which permitted only 1,240 hours. Similarly, they allowed 1,941 hours to reinstall 129 flasks while the engineered standard provided for 1,355. A planner stated the shops complained that they needed more time but had not documented his deviation from the standard and acknowledged that he could not verify that the shop actually needed the additional time.
- Gave 698 hours instead of the 419 allowable for work on hull inserts, using an engineered standard. One planner stated that he had given more time for one shop--210 hours versus the standard allowance of 150 hours--for "standby" time and had adjusted other allowances based on his experience, but he did not document these deviations.
- Could not tell us why 3,600 hours had been given on one submarine and 4,560 hours on another for the same job (assembly and installation of sound isolation hangars). They stated that sometimes more time was given when several submarine overhauls were in progress because it then became harder to do the work.

The Navy SORT reports and shipyard studies have also pointed out problems with inflated "should cost" information. A 1983 SORT review provided the following examples at one shipyard comparing hours actually allowed by planners with hours authorized by labor standards:

	<u>Planner</u>	<u>Hours allowed by Standard</u>
Remove flanged globe valves	62	8
Inspect, clean, and groom fan controllers	648	340
Reinstall fans	518	106
Restore water pumps	170	133
Disassemble and unship blowers	1,828	938
Repair blowers	3,662	1,662
Clean and adjust spring hangers	558	112
Total	<u>7,446</u>	<u>3,299</u>

The SORT report indicated that labor standards were not being used by planners in calculating "should cost" allowances. Similar examples were found by SORT at other shipyards.

The August 1983 Mare Island overhaul cost review report identified similar examples of inflated estimates. For example, the report stated that planners allowed from 32 to 40 hours for installing temporary bunks that were no longer required and allowed about 4,300 to 6,700 hours more than necessary for decontamination and cleaning services.

Shipyards are implementing quality assurance programs to support "should cost" estimates

As mentioned previously, our work, recent SORT reports, and shipyard studies indicated that standards and "should cost" allowances were inflated at naval shipyards. NAVSEA officials told us they had not evaluated shipyard engineered and estimated standards to determine whether "should cost" estimates were adequately supported. They said NAVSEA did not have sufficient resources to effectively monitor and evaluate shipyard work measurement programs and added that NAVSEA depended on shipyards to provide quality assurance.

Shipyard instructions at Mare Island require the shipyard's quality assurance office to annually audit job orders to determine if they (1) are based on engineered standards instead of estimated standards and (2) reflect the proper application of the standard by the planner. However, quality assurance audits have not been conducted. The quality assurance officer stated he had not been aware that such audits were required. Furthermore, methods and standards personnel stated that no one was reviewing the quality of their work and that Mare Island's quality assurance office had not evaluated methods and standards issues.

After the SORT inspections, Norfolk and Mare Island initiated quality assurance programs to ensure labor standards were properly used in calculating estimates. Because those programs

had just started, their effectiveness could not be determined at this time.

#### SUFFICIENT STAFF ARE NEEDED TO MAINTAIN THE WORK MEASUREMENT PROGRAM

Historically, NAVSEA and the shipyards have assigned few staff to methods and standards activities because of the low priority placed on such activities and difficulties encountered in recruiting and retaining qualified technical staff. Those few staff who were assigned have spent most of their time on other duties. According to NAVSEA, staff requirements for work measurement should be sufficient to establish standards for new workloads and to continuously refine existing methods. To do so, NAVSEA believes that 1 industrial engineering technician is needed for every 300 production employees.

Currently, the shipyards are showing ratios of about 1 technician for every 1,000 production workers. Obviously, the low emphasis on methods and standards is reflected in the low levels of personnel available to maintain them. At Norfolk, for example, only 4 employees were assigned to methods and standards work whereas the production engineering officer said more than 30 were needed to comply with NAVSEA's objective.

Mare Island had about 12 technicians assigned to the methods and standards branch, but they have spent little time developing and upgrading labor standards. Mare Island supervisors said that less than one technician staff-year was spent on engineered standards in 1982 and 1983. While Mare Island has recently assigned 15 more technicians to its methods and standards branch, the assignments are short-term assignments and may not resolve long-term recruiting and retention problems.

NAVSEA headquarters also does not have sufficient staff. Until recently, only one person had devoted any time to methods and standards activities at NAVSEA and most of that time was spent on administrative matters and special projects. However, due to the interest in the methods and standards program from the Commander, NAVSEA, additional slots have been requested.

#### GREATER EMPHASIS ON TRAINING IS NEEDED

The few staff involved in methods and standards activities are not being properly trained. In previous years, Mare Island gave little attention to ensuring such personnel were adequately trained. NAVSEA stresses that training is vital to the success of the program and recommends 8 weeks of full-time training for technicians. While many technicians had received some intermittent training, our review of training records disclosed that only two had been given the work measurement course recommended by NAVSEA and only one had comparable training elsewhere.

Mare Island officials said they concentrated on achieving NAVSEA's goal of using engineered standards for 30 percent of the work estimated. They said that spending 8 weeks training personnel, many of whom were on short-term 120-day assignments, was not perceived as the best use of available time.

Beginning in August 1983, all previously untrained technicians and supervisors were given the work measurement course recommended by NAVSEA. However, the branch still does not have a training policy and plan to ensure that replacement personnel receive immediate training. Any plan developed should include appropriate alternatives, such as staggered rotation, under which presently trained shop personnel would remain in the assigned branch until replacements were trained.

To further compound the problem, industrial engineering technicians have not acquired the trade knowledge in the areas for which they are responsible. Mare Island methods and standards supervisors agreed that such knowledge was invaluable in defining work methods and ensuring that industrial engineering technicians considered all aspects of the work when conducting work measurement studies.

Methods and standards personnel at Mare Island have had difficulty recruiting and retaining fully qualified shop mechanics as permanent technicians. Only 6 of the methods and standards branch's 12 permanent industrial engineering technicians have journeyman-level trade experience; the other 6 technicians have no direct production shop experience. As of August 1983, the branch did not have permanent technicians with experience in locations such as the welding, machine, electric, and electronics shops.

As a result, the branch has historically relied on personnel temporarily assigned from production shops for needed expertise. Supervisors cited two problems with this approach. First, "borrowed" mechanics frequently leave before they obtain a good grasp of the program and become productive. Second, they carry with them mixed loyalties which can interfere with their independence and objectivity.

Differences between blue and white collar employees' pay is a major reason Mare Island has had difficulty recruiting fully qualified wage grade mechanics from production shops for permanent assignment as industrial engineer technicians in the methods and standards branch. A personnel official told us that the shipyard had reduced the financial penalty shop personnel incur as technicians by classifying the position as "hard to fill" and using the "save pay" program. This program enables the shipyard to continue paying individuals at the higher rate they earned previously. However, according to the official, the program provides only temporary relief in that General Schedule employees often receive only half the cost-of-living increase given to wage grade employees.

## CONCLUSIONS

Work measurement at naval shipyards has not been effective. Although NAVSEA and shipyard officials recognize the benefits of good work measurement systems, they must actively support them and follow through on actions to make them work if they hope to realize those benefits. Unfortunately, work measurement has been given low priority and, as a result, many problems we previously reported still exist.

Weaknesses in implementing labor standard techniques have contributed to these problems. In particular, many engineered standards we examined were not properly documented and some were based on invalid techniques. Several estimated standards we reviewed had allowances increased for work already covered by existing engineered standards. Finally, shipyard planners had applied standards improperly in calculating how much the work should cost to do.

In many cases, the shortfalls in work measurement activities at the shipyards resulted primarily from management's lack of commitment to operate and maintain a viable work measurement system; ineffective controls to validate "should cost" estimates; insufficient staff to administer methods and standards activities; and inadequately trained industrial engineering technicians who lacked the expertise required to develop, document, and use labor standards properly. In some cases, the low priority afforded work measurement, as well as pay differences and recruiting problems associated with the technical staff, added to these shortfalls.

These weaknesses limit management's ability to solve problems, forecast workloads, and reduce costs. To begin addressing these concerns, various actions have been taken or are under way. SORT reviews, for instance, clearly indicate that NAVSEA intends to revitalize its program monitoring and evaluation role. However, more remains to be done to ensure that needed corrective measures are taken and carried through.

## RECOMMENDATIONS

We recommend that the Secretary of the Navy direct the Commander, NAVSEA, to

- establish an improved work measurement system by ensuring that labor standards are properly set, supported, and used in calculating "should cost" allowances;
- identify and provide the staff required to effectively administer work measurement programs and to do work measurement studies; and



--develop training policies and plans which improve the skills required of those who administer, develop, and upgrade shipyard labor standards.

#### AGENCY COMMENTS

DOD and Navy officials agreed with our recommendations. In providing official oral comments on March 16, 1984, they indicated that improved methods and processes would be developed as the basis for upgrading existing labor standards. Specifically, the Navy is developing an Industrial Process Control System to optimize and standardize the methods for doing work. To implement the system, scheduled to be completed by December 1984, they plan to (1) review and analyze the technical adequacy of current practices for developing and approving industrial processes, (2) develop and issue a directive to explain and clarify such processes, and (3) revise and issue instructions supporting the above actions. They said that the necessary resources would be applied to execute the program at both the NAVSEA and shipyard levels.

DOD spokesmen mentioned further that NAVSEA was developing a plan, in conjunction with its new system discussed above, to train and improve the skills of those involved in work measurement. In addition, the Navy, through its Shipyard Training Modernization Program, has developed courses to instruct those methods and standards personnel who need to acquire trade knowledge.

## CHAPTER 3

### BETTER CONTROLS ARE NEEDED

#### OVER LABOR-CHARGING PRACTICES

The shipyards do not have an effective program to ensure that labor charges are accurate and reliable. For the most part, the shipyards currently use the labor check program to monitor labor-charging practices. However, labor checks are performed infrequently, are often made improperly, and are not always used by management to solve problems. Although NAVSEA has repeatedly emphasized the need for accurate labor charges, additional corrective measures are required to establish an effective labor check program.

Accurate reporting of labor-hours actually charged to work is an essential ingredient in reviewing and improving job standards. Without accurate information on the amount of time employees charge to tasks, the cost accounting systems can neither track nor provide data on the amount of direct and indirect time, such as rework and unproductive time, applied to those tasks. Therefore, managers cannot reasonably evaluate job performance when comparing "should cost" estimates with actual direct time charges. We could not determine the actual amount of direct and indirect time at the shipyards because the required documentation was not available. Instead, we reviewed the controls shipyards employed to assess the accuracy of labor charges.

#### IMPORTANCE OF LABOR CHECKS

The labor check program is a key element in shipyard operations. It is intended to detect inaccuracies in labor cost distribution records which could adversely affect workload forecasting, funds administration, performance evaluation, cost accounting, and development of standards. According to NAVSEA, an adequate labor check program

- produces the necessary information for top management to determine if operating procedures require revision;
- provides information on those responsible for mischarging their time so that disciplinary measures can be taken; and
- enables managers to determine the accuracy of "lost time," defective work and spoilage, and other areas being reported which should be brought to their attention.

Labor charges from employee time cards are the source of labor cost data for the industrial and financial subsystems of the shipyard management information system. Labor verification

entails random checks by shipyard internal review personnel of employees at work and a comparison of the observed work with information reported on time cards by supervisors. For reasons we discuss below, the labor check program at shipyards visited falls short of NAVSEA's expectations.

#### FREQUENCY AND QUALITY OF LABOR CHECKS ARE INADEQUATE

Problems encountered in the labor check program have limited both NAVSEA's and shipyards' ability to evaluate whether employees are charging labor-hours to the proper jobs. Unless NAVSEA resolves the problems, NAVSEA and shipyard managers will be unable to attain their goal of having labor distribution charges accurate 95 percent of the time. Despite the emphasis NAVSEA has placed on effective labor verification programs, the shipyards have done few labor verification checks and the quality of those which they had made was questionable.

For the labor check program to be effective, NAVSEA has suggested that internal review staffs at each shipyard perform about 12,000 labor checks each year to determine the degree of labor charge accuracy. At the Norfolk naval shipyard, however, about 1,900 checks were made in 1982 and only 243 checks were carried out in the first 9 months of 1983. At the Mare Island shipyard, only 133 checks were made in 1981 and none were performed in 1982. In June 1983, Mare Island began making labor checks. Both shipyards cited staffing restrictions as a reason for infrequent checks.

At Mare Island and Norfolk, weaknesses in labor check practices could understate the degree to which employees are mischarging their time. Moreover, shipyard officials and studies indicated that labor mischarging may be far more widespread than current reports show.

For example, a 1982 SORT at one shipyard characterized the shipyard's labor check program as marginal. It noted that the manner in which the program was executed provided numerous opportunities to

" . . . thwart the objectives of the process. Waterfront managers are well versed in the mechanics of the process. Ingenious ways to 'stay out of trouble' have been devised and are effective . . . One experienced and knowledgeable middle level manager stated that the actual mischarge rate may be as high as 30-40% whereas data from present checking and verification activities report that it is only 5%. The fact that blue collar supervisors freely state that they mischarge in order to balance the books . . . is further

evidence that the discipline in the costing procedures is poor to unsatisfactory."

Similarly, at another shipyard, the SORT report strongly alluded to the need for more labor verification, stating that:

"It is common practice in the Production Department to charge labor to Key Operations scheduled to be worked, regardless of actual work being performed . . . which invalidates most of the data in the Shipyard MIS [Management Information System] . . . causing much management information to be misleading or causing its use to be discontinued since it is of no practical value."

Similar problems existed at both Norfolk and Mare Island. For example, at both shipyards labor checkers are highly visible and, lacking trade skills, must usually ask individuals what they are doing. At Norfolk, an official noted that, when a shop knew a check would take place, a 9-percent error rate was usually found whereas unannounced checks generally resulted in 20-percent error rates. Mare Island officials told us that workers routinely reported labor checks to supervisors, who then changed the time cards to ensure that they conformed to the information provided to the checker. In one case, a Mare Island checker had asked supervisors for permission to conduct the checks.

Our review of work sheets used by Mare Island labor checkers to log employee information identified other quality control problems. In 74 out of 92 cases reviewed, checkers had been unable to obtain job order numbers from the employees. One checker certified that the information provided was generally correct when, in fact, no determination could be made. This checker indicated the shipyard had provided little training and that skills were self-taught.

#### PROGRAM RESULTS NOT USED TO CORRECT PROBLEMS

Adequate feedback on problems being encountered is essential for management to assess how well the shipyards are complying with existing policies and directives. In particular, there is no feedback from the shipyards to NAVSEA on the results of the labor check program--a further indication of the inadequate controls currently existing over employee time charges.

Although NAVSEA has adopted the program to monitor the accuracy of labor charges, it has neither required nor received periodic reports on developments or problems the program has uncovered. Because NAVSEA acts more in an advisory capacity, it appears to rely heavily on shipyard managers to resolve problems which the program has identified.

Shipyards also do not appear to be using the results of the labor check program, particularly to identify and impose sanctions against those who mischarge their time. NAVSEA instructions require that disciplinary measures be taken (usually for flagrant abuses) against both military and civilian personnel who mischarge their time. Although June and July 1983 labor checks at 1 shipyard identified 152 and 112 instances of mischarging, respectively, our review did not find any indication of adverse actions which had been taken for mischarging.

Two shop superintendents said they were unaware of any labor check results which had been reported. One stated that he was not aware of penalties for mischarging. Also, shipyard internal review personnel have neither asked for nor received feedback from shops on the results of their labor checks.

#### PROBLEMS IN ACCOUNTING FOR REWORK AND LOST TIME

In reviewing employee work sheets, shipyard labor checkers have had difficulty in distinguishing between what charges involved productive (direct) time as opposed to those involving overhead, such as rework. According to NAVSEA officials, a conflict exists over a standard definition of "productive time." One definition suggests that productive time is the work it takes to do the job correctly the first time; work required for adjustments or for remanufacturing different parts constitutes overhead. Conversely, another definition includes refitting and necessary adjustments as productive work. As a result, labor checkers cannot readily ascertain whether employees' time is being properly recorded to the correct job order.

NAVSEA instructions state that the cost of additional materials and labor necessary to remedy, or "make good," imperfect work should be charged to overhead as "defective work and spoilage." Based on industrywide averages, NAVSEA estimates shipyard rework at between 15 and 25 percent of total costs. One Mare Island document states that rework costs, including labor and materials, were \$68 million in 1982 using the 15-percent figure. However, Mare Island's September 1982 financial report indicated that defective work and spoilage during 1982 totaled about \$700,000, with labor costs at about \$500,000. Therefore, these variances raise questions on whether rework is being appropriately identified, classified, and reported.

NAVSEA is revising its definition of "rework." Shipyards are being encouraged to take a closer look at rework and absorb the rework costs in overhead whenever improper workmanship is involved.

Similar problems exist with the way shipyards accumulate lost time costs, caused primarily by worker idleness, and report them in financial statements. Although we could not determine

the amount of time lost at the shipyards because the required documentation was not available, SORT and labor studies have reported that this problem occurs extensively. To illustrate worker idleness audits performed in 1982-83 at 1 shipyard that more than 15,000 employees were seen not working during a 2-week period.

At Mare Island, though, certain reports indicated that time costs were minimal. Its 1982 financial statements show that less than \$50,000 in labor costs (equivalent to about 100 hours) were charged to lost time out of the 20 million hours worked. These inconsistencies argue for stronger controls to identify lost time charges accurately.

### CONCLUSIONS

Labor costs make up about 65 percent of total shipyard costs. Shipyard labor-charging practices distort the actual cost data which managers need to control and minimize costs. Recognizing the importance of accurate data, NAVSEA requires shipyards to perform labor checks. An effective labor check program (1) informs management of the degree labor is being charged accurately and (2) encourages supervisors to charge labor accurately by identifying those responsible for mischarging.

The shipyards at Mare Island and Norfolk have not implemented effective labor check programs. Specifically, few checks have been performed, and in some cases where checks have been made, they have been inadequate. Also, results of checks are not always used to correct problems. As a result, labor costs have probably understated the degree of mischarging, particularly for certain overhead categories, such as rework and lost time. Furthermore, little effort has been made to follow up on check results and inform management of needed actions.

Recent SORT reports have also identified problems with labor costing. In particular, SORT reviews have criticized the lack of worker idleness at shipyards and concluded that greater discipline in labor-costing procedures is required.

NAVSEA and the shipyards have taken some initial steps to revitalize the labor verification program. In September 1982, for example, NAVSEA required shipyards to regularly report the number of checks conducted and the results achieved. Although these are steps in the right direction, greater emphasis is needed to make labor checks more effective.

### RECOMMENDATION

We recommend that the Secretary of the Navy direct the Commander, NAVSEA, to implement stronger controls to validate the accuracy of labor-charging practices by making sure that

labor checks are done more frequently; are done in the prescribed format; and are used to help management correct problems, such as those relating to rework and lost time.

#### AGENCY COMMENTS

DOD and Navy officials agreed with our recommendation. NAVSEA has recently issued guidance which (1) reemphasized the requirements for an effective labor check program, (2) requested all activities to strengthen the program, and (3) requested monthly and annual reports on the program's results. NAVSEA has also directed the shipyards to train first and second line supervisors on how to charge accurately and control costs. NAVSEA plans to monitor the labor check program to ensure that labor check frequency and quality are improved and program results are used to correct problems.

## CHAPTER 4

### ORGANIZATIONAL GOALS AND

#### INDIVIDUAL PERFORMANCE APPRAISALS

#### COULD BETTER SUPPORT MANAGEMENT'S EFFORTS

As discussed earlier, we reported on problems in shipyard work measurement and labor-charging practices in 1978. While NAVSEA subsequently issued guidance stressing the importance of sound work measurement and labor-costing systems, shipyards have continued to give these areas low priority. As a result, problems cited in the past remain unresolved.

Individual performance evaluations have placed little emphasis on actions needed to solve work measurement and labor-charging problems. We believe that, if properly implemented, shipyard performance appraisal systems could become an effective tool for resolving existing work measurement and labor-costing weaknesses and for "institutionalizing" effective systems.

NAVSEA has already laid the foundation for this by developing plans and issuing instructions governing the performance appraisal process. We believe that, to complete the process, NAVSEA should ensure that shipyards (1) develop goals and department objectives which explicitly address the quality of "should cost" allowances and accuracy of labor charges and (2) ensure that appropriate individual performance appraisals contain challenging and measurable objectives and standards addressing implementation of effective work measurement and cost accounting systems.

#### ORGANIZATIONAL GOALS NEED TO ADDRESS QUALITY OF WORK MEASUREMENT DATA

Although NAVSEA requires that individuals be held accountable for their performance, appraisals apparently have not been used effectively to help eliminate weaknesses in work measurement and labor-costing systems. As an initial step, NAVSEA and shipyards need to establish goals that serve as the basis for standards in performance appraisals, to realistically address problems in work measurement systems.

Fiscal year 1983 and 1984 shipyard goals and department objectives at Mare Island, for example, did not explicitly address the need for improving the quality of "should cost" estimates and accuracy of labor charges. Although NAVSEA is increasing its emphasis on cost control and Mare Island's goals for fiscal year 1984 give cost reduction a high priority, implementing objectives still do not address weaknesses in the shipyard's work measurement and cost accounting systems. Such objectives are important because they serve as guidance for individual performance appraisals for merit pay personnel, who in turn set standards and



objectives for personnel appraised under the basic appraisal program.

A merit pay review board official stated that individual performance appraisals may not emphasize standards, "should costs," and labor charges until they are identified as areas of concern in shipyard goals and/or department objectives.

#### INDIVIDUAL APPRAISALS NEED BETTER PERFORMANCE STANDARDS

In June 1982, NAVSEA stated that poor performance of ship depot maintenance was continuing to be a major problem. As a result, NAVSEA required that personnel at all levels be held fully accountable for their performance. Designated high grade personnel were to be appraised under the merit pay system, and other shipyard employees were to be appraised under the basic performance appraisal program.

However, performance appraisal systems have not been used as effective management tools to improve "should cost" estimating and labor-charging activities. As stated earlier, a major reason for this is that NAVSEA does not have appropriate performance standards and objectives.

We examined performance appraisals for four methods and standards personnel at Mare Island and found that performance standards and objectives did not emphasize the development of many high quality engineered standards. For example, the 1983 merit pay appraisal for the head of Mare Island's methods and standards branch called for him to maintain standards coverage above the 30-percent level (discussed on p. 2) for all shops and improve coverage on shops below 30 percent. He would be "on target" if he maintained the present coverage and issued one new standard for a shop below the 30-percent level. This objective appears to offer little challenge in terms of developing new engineered standards and does not address the quality of labor standards.

Mare Island officials told us, and we verified, that planners and estimators were generally rated on how many job orders and estimated standards they issued within schedule, not on the quality of "should cost" allowances and estimated standards. We also examined appraisals for eight production shop foremen at Mare Island, and only one referred to accuracy of labor charges.

Mare Island's methods and standards branch is developing procedures to ensure that better documentation is developed and kept to support engineered standards. We believe such procedures should be explicit to enable supervisors to document the performance of their staffs. Furthermore, the results of periodic audits by the quality assurance office and other groups could be used as feedback for the performance appraisal process.

Similarly, the quality of "should cost" allowance calculations and estimated standards could be used as a critical element in evaluating the performance of job-planning staff. Mare Island recently initiated a quality assurance audit function to monitor the quality and adequacy of documentation for estimated standards and "should cost" allowances. The results of this program could be used to determine which supervisors were adequately monitoring the work of their staffs. Similar audits carried out by individual supervisors, if properly documented, could be used to evaluate the performance of individual planners.

If a critical performance element were established which held production shop supervisors accountable for accurately reporting labor costs, the results of the shipyard's labor verification program could be used to identify supervisors who need training in proper charging techniques. Similarly, this data could also be used to measure the performance of shop heads.

### CONCLUSIONS

In the past, shipyard managers responsible for work measurement and cost accounting systems have not been held accountable for the accuracy of "should cost" estimates and labor charges data. We believe holding them accountable is an essential first step in eliminating systemic weaknesses and, subsequently, in maintaining viable systems. Performance appraisal systems are already available to do this; however, appropriate performance goals and objectives addressing the need to maintain high quality labor standards have not been set. In addition, individual appraisals have not been used effectively to ensure that personnel at all levels involved in work measurement and cost accounting are implementing and maintaining a viable work measurement program.

### RECOMMENDATION

We recommend that the Secretary of the Navy direct the Commander, NAVSEA, to set organizational goals and objectives which address the quality of work measurement activities and include these activities in designing and incorporating mandatory entries on performance evaluations to measure the effectiveness of shipyard employees involved.

### AGENCY COMMENTS AND OUR EVALUATION

DOD and Navy spokesmen said that organizational goals and objectives which address work measurement are being considered for incorporation in NAVSEA's Depot Operations Improvement Program. However, they did not agree that mandatory performance elements were needed. They said that problems existing in labor standards development and cost-charging practices would make it virtually impossible to obtain fair and objective measurements of performance.

We believe those who administer, develop, and upgrade labor standards should be held accountable for their performance. As discussed previously, this is an essential first step in eliminating systemic weaknesses and, later, in maintaining effective systems. We believe that the performance appraisal process is an excellent vehicle to ensure that personnel involved in work measurement implement and maintain a viable program.

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